REMARKS

In response to the Official Action mailed October 1, 2002, Applicants amend their application and request reconsideration. In this Amendment, claim 3 is cancelled leaving claims 1, 2, and 4-20 pending.

Certain claims were rejected as indefinite. The rejections with regard to claims 2 and 16 have been overcome by clarifying amendments of those claims. Claim 12 has been amended, as has claim 9, from which claim 12 depends. Every term in claim 12 has proper antecedent basis.

In this Amendment, the independent claims have been clarified. Claim 1, the most fundamental claim, has been substantially revised in a way that is entirely consistent with the disclosure of the patent application. The other two independent claims, claim 9 and claim 15 incorporate the limitation of amended claim 1.

An important feature of the invention is a carbon body structure that is an alternative to a structure of carbon nanotubes. An example of the structure is illustrated in Figure 3 of the patent application. This structure is deposited on and supported by a substrate, element 1 in that figure. The structure includes continuous walls that intersect and are connected with each other and that are transverse to the substrate. There are spaces between the walls where the walls do not intersect and the walls define openings that have perimeters defined by the walls.

Claim 9 describes a process of making the carbon body and claim 15 describes a field emission electron source that incorporates the carbon body.

Claims 1-4, 7, and 15-20 were rejected as anticipated by Yaniv et al. (U.S. Patent 6,312,302, hereinafter Yaniv). This rejection is respectfully traversed.

Yaniv is entirely different from the invention because Yaniv concerns a carbon nanotube structure. As illustrated in a side view in Figure 1 of Yaniv, conventionally, the nanotubes are formed on a substrate with orientations in arbitrary directions with respect to the substrate. Yaniv describes, in column 1, lines 9-17, the structure of his Figure 1 as a "random organization of the carbon nanotube fibers". Given the knowledge in the art concerning carbon nanotubes, for example, see Figures 25 and 26 of the present patent application as well as Yaniv, it is apparent that there is a substantial difference between the carbon body of the invention and carbon nanotubes.

As described by Yaniv, the nanotubes are fiber-like and, as described elsewhere, they are needle-like. The carbon nanotubes, even when aligned according to the apparently novel subject matter described in Yaniv, do not form continuous walls that are connected and intersect with each other and are transverse to a supporting substrate like the carbon body of all the pending claims. Thus, the prior art rejection cannot be maintained as to any claim.

In applying Yaniv to the respective examined claims, which are clarified in this Amendment, the Examiner characterized the nanotubes of Yaniv as having a thickness, as a thin layer, and as having a continuous curved wall with a net-like structure. This characterization is incorrect and even at odds with what is described by Yaniv. Although the language cited by the Examiner with respect to claim 2, like the language cited with respect to claim 1, is no longer present in claim 2, the assertion that Figure 1 of Yaniv shows curved walls having openings and peripheral portions is totally incorrect and contrary to what is described by Yaniv. With regard to claim 4, Figure 4 of Yaniv does not show a continuous film within the openings of the oriented nanotube structure as asserted by the Examiner. Moreover, the structure defined by amended claim 4, which finds support in the embodiment of Figure 10 of the patent application, is substantially different from anything described by Yaniv. Certainly, with respect to Figure 1 of Yaniv, it is not apparent that the carbon nanotubes are all in contact in a way that would produce a continuous electrical current flow path between every pair of nanotubes as in the carbon body of amended claim 7 and as asserted with respect to examined claim 7.

Claims 15 and 16 describe a field emission electron source and the Examiner relies upon the same language of those examined claims as relied upon in examined claims 1 and 2 in asserting that claims 15 and 16 are anticipated by Yaniv. For the same reasons that claims 1 and 2, and particularly amended claims 1 and 2, cannot be anticipated by Yaniv, amended claims 15 and 16 cannot be anticipated by Yaniv.

Likewise, claims 17-20, each of which ultimately depends from amended claim 15, cannot be anticipated by Yaniv.

Claims 5, 6, and 8-14 were rejected as unpatentable over Yaniv, considered by itself. These rejections are respectfully traversed.

Claims 5, 6, and 8 have been clarified and those claims depend from amended claim 1. Even if the limitations of claims 5, 6, and 8 are found in Yaniv, and Applicants do not concede that those limitations are found in Yaniv, the claims cannot be obvious in view of Yaniv since Yaniv cannot anticipate amended claim 1. That anticipation of claim 1 is an essential element in the rejection of claims 5, 6, and 8. Therefore, the rejection of those three dependent claims must be withdrawn.

Claims 9-14 are all of the process claims of the patent application and are all directed to a method of making the novel carbon body that is the subject matter of the patent application. The Examiner asserted with respect to these claims that the process steps "are inherently performed during making the product claims 1-8". This statement is erroneous, and is without factual basis. There is no legal precedent that permits this rejection. Claims 1-8 are not product-by-process claims and there is no suggestion that the process described in claims 9-14 is the

exclusive way of forming the novel carbon body that is the central focus of the patent application.

Any reliance upon Yaniv in rejecting method claims 9-14 is erroneous because there is no description within Yaniv of any method of even making the carbon nanotubes that are the subject of that patent. Moreover, as demonstrated in the present patent application, particularly with respect to Figures 6, 7, 9, and 11 and the corresponding description in the patent application at pages 23-25, if proper process conditions are not established, then neither carbon nanotubes nor the novel carbon body will be produced. If Yaniv, in describing carbon nanotubes had disclosed a process for making his carbon nanotubes, that process could not suggest claims 8-14, because the process would not produce the novel carbon body. The rejection of the process claims 8-14 is totally erroneous and must be withdrawn.

Reconsideration and allowance of the claims now pending are appropriate and earnestly solicited.

Respectfully submitted,

Jeffrey A. Wyand, Reg. No. 29,458
LEYDIG, VOIT & MAYER
700 Thirteenth Street, N.W., Suite 300
Washington, DC 20005-3960
(202) 737-6770 (telephone)
(202) 737-6776 (facsimile)

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

HOSONO et al.

Application No. 09/871,976 Art Unit: 2841

Filed: June 4, 2001 Examiner: T. Tran

For: CARBON BODY, PROCESS FOR PRODUCING THE CARBON BODY, AND ELECTRIC FIELD EMISSION ELECTRON SOURCE USING THE CARBON BODY

AMENDMENTS TO CLAIMS MADE IN RESPONSE TO OFFICE ACTION DATED OCTOBER 1, 2002

Amendments to existing claims:

Cancel claim 3.

1. (Twice Amended) A structure including a carbon body comprising:
a substrate; and
a carbon body ~~that has a thickness~~ disposed on the substrate and ~~is a thin layer~~ having ~~a front surface and a back surface, including at least at the front surface a continuous curved wall, as viewed in plan, having a netlike structure~~ a plurality of continuously connected intersecting walls transverse to the substrate.

2. (Twice Amended) The structure including a carbon body according to claim 1, wherein ~~said curved wall approximately surrounds~~ the continuously connected intersecting walls define perimeters of openings ~~in a curved form, as viewed in plan, as peripheral portions of the openings~~ between locations where the continuous connected intersecting walls intersect.

4. (Twice Amended) The structure including a carbon body according to claim ~~1~~ 2, ~~wherein a base that occupies the back surface within said carbon body is~~ including a continuous carbon film ~~embedded in~~ on the substrate and only partially filling the openings.

5. (Twice Amended) The structure including a carbon body according to claim 1, wherein ~~said curved wall~~ the carbon body has a hexagonal ~~crystal~~ crystalline structure with a bottom plane parallel to ~~a direction that crosses~~ the ~~front surface of said carbon body~~ substrate.

6. (Twice Amended) The structure including a carbon body according to claim 1, wherein ~~said curved wall has~~ the continuously connected intersecting walls have an average thickness of no more than 100 nm.

7. (Twice Amended) The structure including a carbon body according to claim 1, wherein an electrical current can flow between any two points on the carbon body.

8. (Twice Amended) The structure including a carbon body according to claim ~~3~~ 1, wherein the ~~object~~ substrate is a glass substrate.

9. (Twice Amended) A process for producing a structure including a carbon body, the process including;

generating a plasma in a ~~gas~~ mixture of gases containing a gaseous carbon compound; and

applying a magnetic field and electromagnetic waves to the plasma to ~~form the~~ establish a resonance condition for electrons in the plasma, producing a reaction in the gaseous carbon compound and forming a carbon body on a surface of ~~an object~~ a substrate ~~by chemical vapor deposition, wherein the magnetic field and the electromagnetic waves satisfy a resonance condition for electrons in the plasma~~, the carbon body having a plurality of continuously connected intersecting walls transverse to the substrate.

10. (Twice Amended) The process for producing the carbon body according to claim 9, wherein the magnetic field and the electromagnetic waves advance in a direction parallel to the magnetic field, crossing the surface of the ~~object~~ substrate.

12. (Twice Amended) The process for producing the carbon body according to claim 9, wherein the mixture of gases ~~for generating the plasma include a carbon containing compound and~~ includes hydrogen~~, and the hydrogen has~~ in a concentration range from 25% to 75%.

13. (Twice Amended) The process for producing the carbon body according to claim 9, wherein the ~~object~~ substrate is a glass substrate.

14. (Twice Amended) The process for producing the carbon body according to claim 9, wherein the ~~object~~ substrate is heated ~~at~~ to no more than 700°C.

15. (Twice Amended) An electric field emission ~~type~~ electron source~~,~~ including:

a substrate; and

a carbon body ~~having a front surface with a continuous curved wall having a netlike structure~~ on the substrate as an electron emitting member for emitting electrons, the carbon body comprising a plurality of continuously connected intersecting walls transverse to the substrate.

16. (Twice Amended) The electric field emission ~~type~~ electron source according to claim 15, wherein the ~~wall surrounds openings and the openings have a diameter larger than height of the wall~~ continuously connected intersecting walls define perimeters of openings between locations where the continuously connected intersecting walls intersect.

17. (Twice Amended) The electric field emission ~~type~~ electron source according to claim 15, including a cathode electrode for supplying electrons to ~~said~~ the carbon body, and an extraction electrode for generating an electric field for inducing emission of ~~the~~ electrons from ~~said~~ the carbon body, wherein ~~said~~ the carbon body is positioned ~~in front of~~ opposite the cathode electrode, contacting the cathode electrode, and the extraction electrode is positioned ~~in front of~~ opposite the carbon body ~~so that the extraction electrode does not overlap~~ without overlapping the carbon body, ~~as~~ when viewed in ~~plan~~ a direction transverse to the substrate.

18. (Twice Amended) The electric field emission ~~type~~ electron source according to claim 15, including a cathode electrode for supplying electrons to ~~said~~ the carbon body, and a backside extraction electrode, positioned at a rear side of ~~said~~ the carbon body, for generating, from the rear side of the carbon body, an electric field for inducing emission of ~~the~~ electrons from ~~said~~ the carbon body, wherein the cathode electrode is positioned ~~in front of~~ opposite the backside extraction electrode, and ~~said~~ the carbon body is positioned ~~in front of~~ opposite the cathode electrode, contacting the cathode electrode.

19. (Twice Amended) The electric field emission ~~type~~ electron source according to claim 18, wherein the cathode electrode is located only at a periphery of ~~said~~ the carbon body.

20. (Twice Amended) The electric field emission ~~type~~ electron source according to claim 18, wherein the cathode electrode is positioned outside the backside extraction electrode and not overlapping with the backside extraction electrode ~~as~~, when viewed in ~~plan~~ a direction perpendicular to the substrate.

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HOSONO et al.

Application No. 09/871,976 Art Unit: 2841

Filed: June 4, 2001 Examiner: T. Tran

For: CARBON BODY, PROCESS FOR PRODUCING THE CARBON BODY, AND ELECTRIC FIELD EMISSION ELECTRON SOURCE USING THE CARBON BODY

PENDING CLAIMS AFTER AMENDMENTS MADE IN RESPONSE TO OFFICE ACTION DATED OCTOBER 1, 2002

1. A structure including a carbon body comprising:

a substrate; and

a carbon body disposed on the substrate and having a plurality of continuously connected intersecting walls transverse to the substrate.

2. The structure including a carbon body according to claim 1, wherein the continuously connected intersecting walls define perimeters of openings between locations where the continuous connected intersecting walls intersect.

4. The structure including a carbon body according to claim 2, including a continuous carbon film on the substrate and only partially filling the openings.

5. The structure including a carbon body according to claim 1, wherein the carbon body has a hexagonal crystalline structure with a bottom plane parallel to the substrate.

6. The structure including a carbon body according to claim 1, wherein the continuously connected intersecting walls have an average thickness of no more than 100 nm.

7. The structure including a carbon body according to claim 1, wherein an electrical current can flow between any two points on the carbon body.

8. The structure including a carbon body according to claim 1, wherein the substrate is a glass substrate.

9. A process for producing a structure including a carbon body, the process including;

generating a plasma in a mixture of gases containing a gaseous carbon compound; and

applying a magnetic field and electromagnetic waves to the plasma to establish a resonance condition for electrons in the plasma, producing a reaction in the gaseous carbon compound and forming a carbon body on a surface of a substrate, the carbon body having a plurality of continuously connected intersecting walls transverse to the substrate.

10. The process for producing the carbon body according to claim 9, wherein the magnetic field and the electromagnetic waves advance in a direction parallel to the magnetic field, crossing the surface of the substrate.

11. The process for producing the carbon body according to claim 9, wherein the electromagnetic waves are microwaves.

12. The process for producing the carbon body according to claim 9, wherein the mixture of gases includes hydrogen in a concentration range from 25% to 75%.

13. The process for producing the carbon body according to claim 9, wherein the substrate is a glass substrate.

14. The process for producing the carbon body according to claim 9, wherein the substrate is heated to no more than 700°C.

15. An electric field emission electron source including:

a substrate; and

a carbon body on the substrate as an electron emitting member for emitting electrons, the carbon body comprising a plurality of continuously connected intersecting walls transverse to the substrate.

16. The electric field emission electron source according to claim 15, wherein the continuously connected intersecting walls define perimeters of openings between locations where the continuously connected intersecting walls intersect.

17. The electric field emission electron source according to claim 15, including a cathode electrode for supplying electrons to the carbon body, and an extraction electrode for generating an electric field for inducing emission of electrons from the carbon body, wherein the carbon body is positioned opposite the cathode electrode, contacting the cathode electrode, and the extraction electrode is positioned opposite the carbon body without overlapping the carbon body, when viewed in a direction transverse to the substrate.

18. The electric field emission electron source according to claim 15, including a cathode electrode for supplying electrons to the carbon body, and a backside extraction electrode, positioned at a rear side of the carbon body, for generating, from the rear side of the carbon body, an electric field for inducing emission of electrons from the carbon body, wherein the cathode electrode is positioned opposite the backside extraction electrode, and the carbon body is positioned opposite the cathode electrode, contacting the cathode electrode.

19. The electric field emission electron source according to claim 18, wherein the cathode electrode is located only at a periphery of the carbon body.

20. The electric field emission electron source according to claim 18, wherein the cathode electrode is positioned outside the backside extraction electrode and not overlapping with the backside extraction electrode, when viewed in a direction perpendicular to the substrate.